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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/054,520	01/22/2002	Kwang-Jun Cho	29926/37960	5978

4743 7590 06/05/2003

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EXAMINER

PHAM, HOAI V

ART UNIT PAPER NUMBER

2814

DATE MAILED: 06/05/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application N .

10/054,520

Applicant(s)

CHO ET AL.

Examiner

Hoai V Pham

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-- The MAILING DATE of this communication appears on the reverse sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 January 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-17 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-7 and 12-16 is/are rejected.
- 7) ☒ Claim(s) 8-11, 17 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Specification

1. The disclosure is objected to because of the following informalities:

In the Description of the Related Art

Page 3, lines 16-27, the reference numerous (300, 305, 310, 315, 320, 325, 330, and 335) is not shown in the figure 2.

Appropriate correction is required.

The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

Claim Objections

2. Claims 1 and 2 are objected to because of the following informalities:

Claim 1, line 13, "Tin" should be changed to --TiN--.

Claim 1, line 17, the term "pattern" should be deleted for clarifying the scope of the claim.

Claim 2, line 3, "a contact hole" should be changed to --the contact hole --.

Claim 2, line 4, the term "optionally" should be deleted for clarifying the scope of the claim.

Appropriate correction is required.

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Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1-7, 12-14 and 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang et al. [U.S. Pat. 6,436,763] in view of Kim et al. [U.S. 2001/0054730].

With respect to claims 1 and 12, Huang et al. (figs. 1-5, cols. 5-7) discloses a method for manufacturing a semiconductor device, comprising:

a) forming a contact hole (2, 4) to expose a joining portion (15) by etching an inter-layer insulation layer (24) disposed on top of a semiconductor substrate (10) (fig. 1, col. 6, lines 42-57);

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- b) forming a contact plug (26) inside the contact hole (fig. 1, col. 6, lines 54-57;
- c) molding an etch stop layer (28) and a sacrificial oxide layer (30) on the contact plug and the inter-layer insulation layer (fig. 2, col. 6, lines 60-67);
- d) molding a storage node hole (5) to expose the contact plug by etching the etch stop layer and the sacrificial oxide layer (fig. 2, col. 7, lines 3-8);
- e) forming a bottom electrode comprising a polysilicon layer (32) inside the storage node hole by a (fig. 3, col. 7, lines 13-15);
- f) separating the bottom electrode by removing the polysilicon layer (32) until the sacrificial oxide layer is exposed using chemical mechanical polished back (fig. 3, col. 7, lines 13-15);
- g) exposing the bottom electrode by removing the sacrificial oxide layer (fig. 4, col. 7, lines 24-26);
- h) forming a dielectric layer (34) on the bottom electrode pattern (fig. 6, col. 7, lines 29-40); and
- i) molding a top electrode (36) on the dielectric layer (fig. 5, col. 7, lines 41-55).

Huang et al. fails to disclose forming the bottom electrode comprising a TiN by a CVD method. However, Kim et al. discloses the bottom electrode (160) comprising a TiN by a CVD method (fig. 6, col. 3, paragraph [0042]) and the TiN bottom electrode (160) layer is removed in the chemical-mechanical polishing method until the sacrificial oxide layer (142) is exposed (fig. 6, col. 3, paragraph [0044]). Therefore, it would have been obvious to the skilled in the art to form the

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TiN bottom electrode by CVD method as taught by Kim et al. into the process of Huang et al. because forming the TiN lower electrode with the process as set forth above would provide a good step coverage (col. 2, paragraph [0031]) and TiN bottom electrode having a high work function would provide a negligible leakage current, high capacitance and the suitability for mass production (col. 1, paragraph [0007] and col. 2, paragraph [0021]).

With respect to claim 2, Huang et al. discloses forming the contact hole by etching the inter-layer insulation layer; and depositing a conductor layer inside the contact hole and leveling the conductor layer (fig. 1, col. 6, lines 50-57).

With respect to claim 3, Huang et al. discloses that the depositing and leveling of the conductor layer is carried out with a CMP (fig. 1, col. 6, lines 54-57).

With respect to claim 4, Huang et al. discloses the etch stop layer comprising Si_3N_4 (fig. 1, col. 6, lines 60-61).

With respect to claim 5, Huang et al. discloses that at part d) of forming the storage node hole (5), the sacrificial oxide layer (30) and the etch stop layer (28) are plasma etching (dry etched) (fig. 2, col. 7, lines 3-6).

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With respect to claim 6, Huang et al. discloses that at part d) of forming the storage node hole (5), the inter-layer insulation layer around the contact plug is exposed (fig. 2).

With respect to claim 7, Huang et al. discloses the contact plug (26) comprising polysilicon (col. 6, lines 54-55).

With respect to claim 13, Huang et al. fails to disclose that the dielectric layer is selected from the group consisting of BST, STO, PZT, PLZT, SBT, TaON and Ta₂O₅. However, Kim et al. discloses that the dielectric layer is Ta₂O₅ (fig. 8, col. 3, paragraph [0045]). Therefore, it would have been obvious to the skilled in the art to form Ta₂O₅ for the dielectric layer as taught by Kim et al. into the process of Huang et al. because Ta₂O₅ material would have a high-K dielectric constant (col. 2, paragraph [0032]), which provides an excellent step coverage and an excellent leakage current characteristics (col. 3, paragraph [0038]).

With respect to claim 14, Huang et al. fails to disclose that the top electrode is selected from the group consisting of TiN, Ru, Pt, Ir, Os, W, Mo, Co, Ni, Au, Ag, RuO₂ or IrO₂. However, Kim et al. discloses that the top electrode (190) is selected from the group consisting of Ru, Pt, RuO₂ or IrO₂ (fig. 8, col. 2, paragraph [0033] and col. 4, paragraph [0049]). Therefore, it would have been obvious to the skilled in the art to form the top electrode of Huang et al. with the material as set forth above because as taught by Kim et al., these electrode

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materials would provide good electrical characteristics as the leakage current characteristics (col. 2, paragraph [0033]).

With respect to claim 15, Huang et al. and Kim et al. disclose that a capacitor made in accordance with the method of claim 1 (see above).

With respect to claim 16, Huang et al. and Kim et al. disclose that a capacitor made in accordance with the method of claim 3 (see above).

Allowable Subject Matter

6. Claims 8-11 and 17 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

7. The following is a statement of reasons for the indication of allowable subject matter: the prior art of record fails to disclose a step for molding a silicide layer on the contact plug after part d) of forming the storage node hole while having the characteristics as recited in claim 1.

Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hoai V Pham whose telephone number is 703-308-6173. The examiner can normally be reached on 6:30A.M. - 6:00P.M..

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9. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael M. Fahmy can be reached on 703-308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7724 for After Final communications.

10. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

A handwritten signature in black ink, appearing to read 'Hoai Pham', with a long, sweeping horizontal line extending to the right.

Hoai Pham
May 30, 2003